



Changkat Changi Secondary School

UNIT 17

Practical Electricity

Name: _____

Class: _____

Date: _____

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NOTES 17.1

LESSON OBJECTIVES

At the end of the lesson, you will be able to:

- Describe the use of the heating effect of electricity in appliances
- Recall and apply the relationship $P = VI$ and $E = VIt$
- Calculate the cost of using electrical appliances in units of kWh

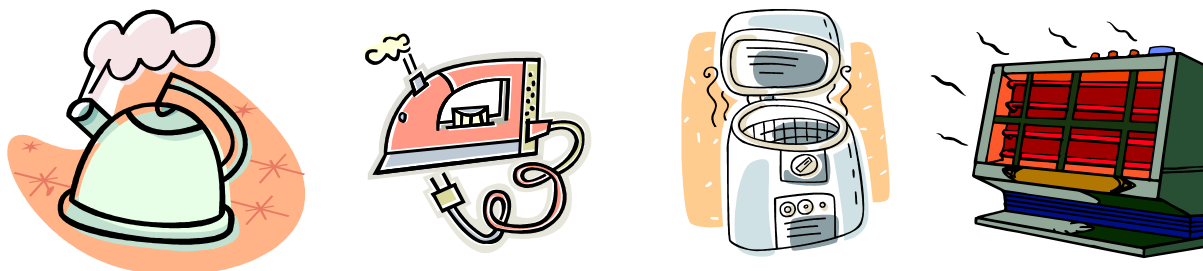
Electricity is widely used in the modern world. It is so much a part of our daily lives that we tend to take it for granted.

In this section, we will be looking at some common household appliances that use electricity and we will also learn about electrical power and how it is calculated.

Uses of Electricity

Electricity is most commonly used in electric heating, lighting and motors.

There are many electrical appliances which make use of the heating effect of electric current. Some of these common household appliances are electric iron, immersion heaters, kettles and cookers.



In these cases, electrical energy is converted to heat energy. The heating elements used in kettles, irons, ovens and heaters are usually made of nichrome wires.

Nichrome is used as a heating element as it has a high resistance and a high melting point, and it does not oxidize easily.

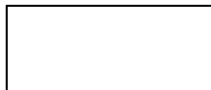
Finding amount of electrical energy *used by a device*,

In *Unit 15: Current Electricity*, recall that

$$E = VQ \text{ ----- (1) and}$$

$$Q = It \text{ ----- (2)}$$

Substituting (2) into (1), we have



S.I. unit for energy is _____

Example

What is the electrical energy converted to heat by a 240 V light bulb that is switched on for 300 seconds ?
A current of 5 A is moving through the bulb.

Electrical Power P

In *Unit 6: Energy, Work and Power*, power P is defined as the rate of work done or energy converted.

With $P = \frac{E}{t}$ and recall that $E = VIt$, electrical power can be written as

S.I. unit for power is _____ ()

Example

Complete the following table to find the power, voltage or current of the given appliances.

APPLIANCE	POWER (W)	VOLTAGE (V)	CURRENT (A)
Lamp		240	0.25
Television	120		0.5
Hair dryer	500	250	
Air-con		250	8

Calculating the Cost of Electricity Consumption

The kilowatt-hour is the unit used for calculating the amount of electricity used. One kilowatt-hour (kWh) is the amount of electrical energy used by a 1kW device in one hour.

To calculate the cost of electrical consumption, we use:

Example

Calculate the cost of using a kettle with power 2 kW for 0.5 hrs if 1 kWh costs 20 cents.

Example (Finding energy in joules versus kWh)

An electric kettle operates at 2 kW if it is used for 10 minutes.

(a) Find the energy consumed in (i) joules, (ii) kWh.

(b) If 1 kWh costs 0.20 cents, calculate the cost of using the kettle

NOTES 17.2

LESSON OBJECTIVES

At the end of the lesson, you will be able to:

- State the hazards of using electricity
- Explain the use of fuses, circuit breakers, the need for earthing metal cases and for double insulation
- State the meaning of the terms live, neutral and earth
- Describe the wiring in a mains plug
- Explain why switches, fuses and circuit breakers are wired into the live conductor

Dangers of Electricity

Although electricity plays a very important part in our daily lives, it can also be very dangerous.

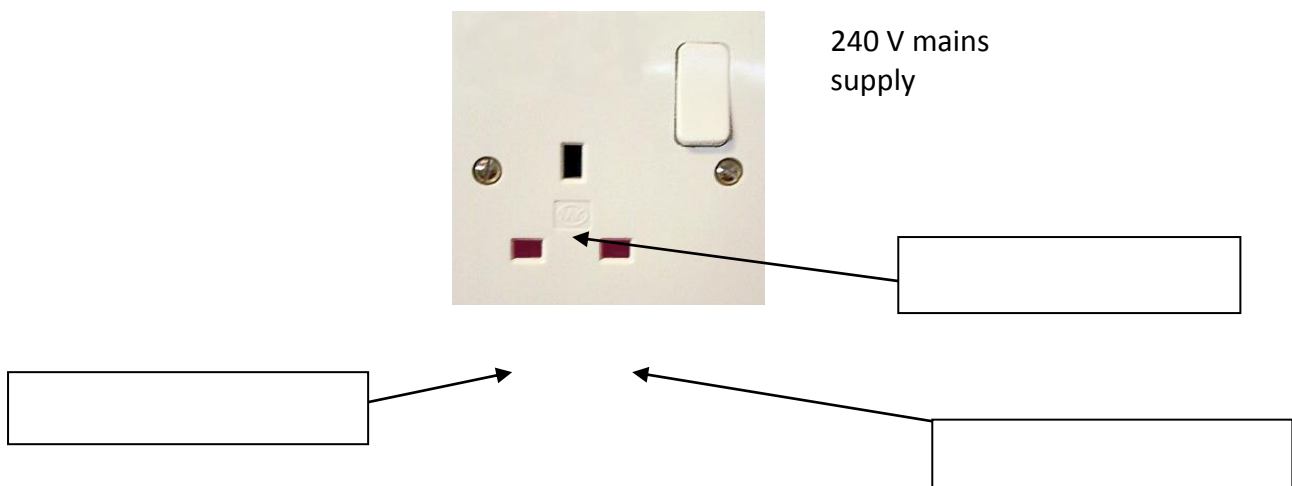
Electrical faults in appliances or circuits can cause fires and electric shocks.

Electricity can be dangerous due to three reasons – damaged insulation, overheating of cables and damp conditions.

Can you think about how each of them can become dangerous?

Parts of the Power point

Diagram below shows a power-point with a switch. The three holes are connection points to what are known as **Live**, **Neutral** and **Earth** connections.



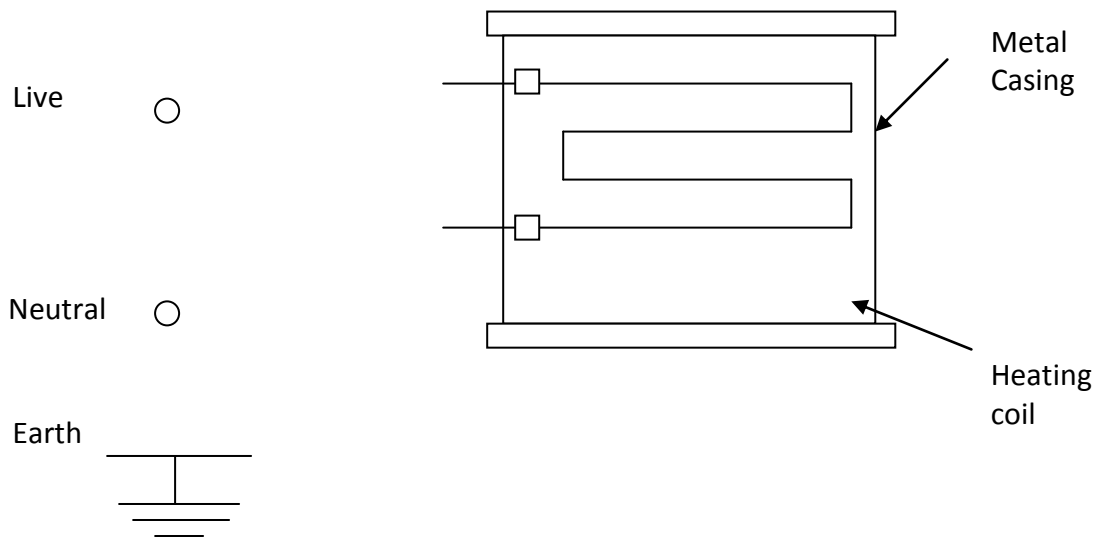
In a **240 V A.C. power supply**,

Live point is at a potential difference of _____;

Neutral point is at a potential difference of _____;

and the Earth point is a potential difference of _____.

A representation of how the three points are connected to an electrical device is shown below. Can you draw how the wires will be connected? If a current of 5 A is supplied to the device, can you indicate on three points what is the current flowing through them?



Example

Tasha want to determine the voltage and current in a power point, she uses a multimeter (one that can measure voltage, resistance and current) to check. What will she observe at each point for a 240 V, a.c. supply that is supplying 7A of current in the circuit?

	Voltage	Current
Live Point		
Neutral Point		
Earth Point		

Safety features used

To ensure electrical devices are safely used, some features are considered in the design of an electrical device.

1. Switch

Switches are installed to turn off the power in electrical appliances. Switches should be installed on _____wire____ so that when the switch is open,

2. Fuse

A fuse protects USER and APPLIANCE from electric shock when the current in the live wire exceeds the required amount, causing the fuse wire to melt and break the supply of current.



For a fuse to work, it has to be placed in the _____ wire.

Fuse rating is the maximum current the fuse can carry without melting.

Examples are 1 A, 5 A and 13 A.

Note: It is important to select a fuse with fuse rating _____ than the current flowing in the circuit.

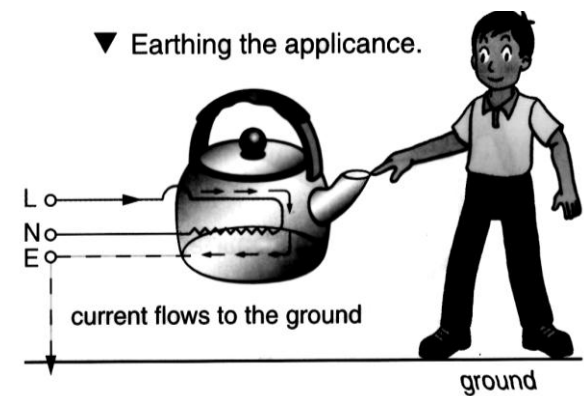
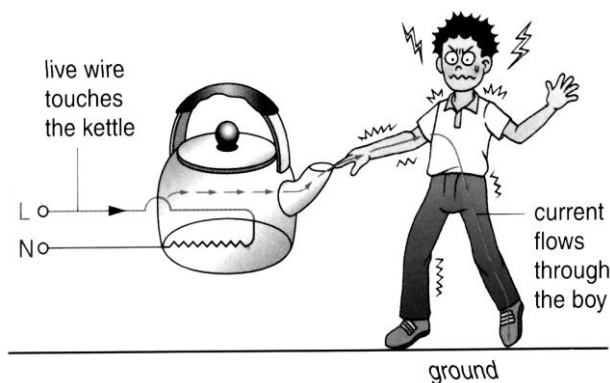
Symbol for fuse is

Example

What is the suitable fuse to be used with a kettle of 1000 W and connected to a 240 V power supply?

3. Earth Connection

The earth wire is usually connected to _____ of an appliance. This is so that in case the live wire accidentally touches the metal case, the earth wire will _____.



4. Double Insulation

Double insulated appliances-- have their metal parts surrounded by thick insulating plastic, making it impossible for the user to touch the metal parts.



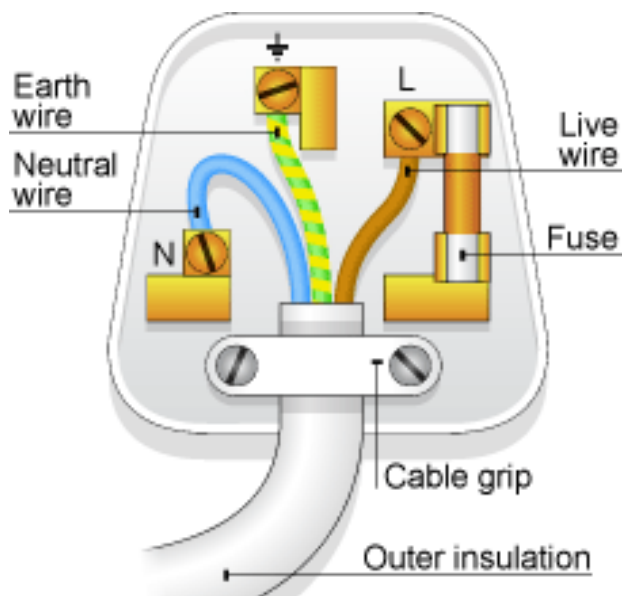
Double insulated wires have two layers of insulation to prevent user from directly touching the wires and also protect the wires in an event of overheating.

Sometimes, due to double insulation provided and low voltage usage of a device, earth wire is not used. E.g. DVD players, electric toaster, table lamps.



5. Safety at the three-Pin Plug

The wiring of a three-pin plug is as follows:



Recognising connection of wires by colours :

Wires to Neutral pin : _____

Wires to Live pin : _____

Wires to Earth pin : _____

Note that

1. the fuse is connected

2. The cable grip is fixed over the

_____.